Remarks

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 1-47 are pending in the application, with claims 1, 20 and 29 being the independent claims.

Based on the following remarks, Applicant respectfully requests that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

Double Patenting Rejection

The Examiner has provisionally rejected claims 1-19 and 29-47 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-24 of copending U.S. Patent Application No. 09/832,131. For the reasons set forth below, Applicant respectfully traverses.

The sole basis provided by the Examiner for this rejection is that the allegedly conflicting claims "are not patentably distinct from each other because the claims of [Application No.] 09/832,131 recite similar subject matter to that of the present invention, but in a more generic format." *See* Office Action at page 3. In other words, the Examiner has based his double patenting rejection upon the fact that the claims of Application 09/832,131 are allegedly dominant with respect to claims of the present application. However, domination is not a proper basis for an obviousness-type double patenting rejection. As set forth in the MPEP:

> Domination and double patenting should not be confused. They are two separate issues. One patent or application "dominates" a second patent or

> application when the first patent or application has a broad or generic claim which fully encompasses or reads on an invention defined in a narrower or more specific claim in another patent or application. ***Domination by itself, i.e., in the absence of statutory or nonstatutory double patenting grounds, cannot support a double patenting rejection.*** *In re Kaplan*, 789 F.2d 1574, 1577-78, 229 USPQ 678, 681 (Fed. Cir. 1986); and *In re Sarrett*, 327 F.2d 1005, 1014-15, 140 USPQ 474, 482 (CCPA 1964). However the presence of domination does not preclude double patenting. See, e.g., *In re Schneller*, 397 F.2d 350, 158 USPQ 210 (CCPA 1968).

See MPEP, § 804 (emphasis added).

Since the sole basis provided by the Examiner for the obviousness-type double patenting rejection is domination, and since domination cannot by itself support a nonstatutory double patenting rejection, Applicant respectfully traverses. Accordingly, Applicant requests that the rejection of claims of claims 1-19 and 29-47 under the doctrine of obviousness-type double patenting be reconsidered and withdrawn.

Rejections under 35 U.S.C. § 103

Rejections over Marcellin and Cuperman

The Examiner has rejected claims 1-10, 12, 13, 15, 16, 18, 29-38, 40-43 and 45 under 35 U.S.C. § 103(a) as unpatentable over Marcellin *et al.*, "A Trellis-Searched 16 KBit/Sec Speech Coder with Low Delay," ADVANCES IN SPEECH CODING, dated March 5, 1992 ("Marcellin") in view of U.S. Patent No. 4,963,034 to Cuperman *et al.* ("Cuperman" or "Cuperman patent"). For the reasons set forth below, Applicant respectfully traverses.

As an initial matter, it is noted that the Examiner has withdrawn the prior rejection of claims 1-10, 12, 13, 15, 16, 18, 20-27, 29-38, 40-43, 45 and 47 as obvious over of Marcellin in view of Watts *et al.*, "A Vector ADPCM Analysis-By-Synthesis

Configuration for 16 kbit/s Speech Coding," IEEE GLOBAL TELECOMMUNICATIONS CONFERENCE & EXHIBITION: "COMMUNICATIONS FOR THE INFORMATION AGE," 1988 ("Watts" or "Watts reference"). However, Cuperman teaches what appears to be the same analysis-by-synthesis ("A-S") coding configuration taught in the Watts reference. This is not surprising, since Watts and Cuperman are both the authors of the Watts reference as well as named inventors on the Cuperman patent. Thus, Applicant's arguments with respect to the patentability of the pending claims over the combination of Marcellin and Watts are much the same as Applicant's arguments with respect to the patentability of the pending claims over the combination of Marcellin and Cuperman. Indeed, since the Examiner has withdrawn his rejection of the claims over the combination of Marcellin and Watts, there appears to be no reasonable way the Examiner can maintain a rejection of the claims over Marcellin and Cuperman, since the combinations are essentially the same. Nevertheless, Applicant will once again address the merits of these rejections below.

Independent claims 1 and 29 each generally relate to a novel way of performing vector quantization in a Noise Feedback Coding (NFC) system. In particular, independent claim 1 is directed to a method in an NFC system of efficiently searching N predetermined Vector Quantization (VQ) codevectors for a preferred one of the N VQ codevectors to be used in coding a speech or audio signal. The method of claim 1 includes the steps of:

(a) predicting the speech signal to derive a residual signal;

(b) deriving a ZERO-INPUT response error vector common to each of the N VQ codevectors, wherein the ZERO-INPUT response error vector is a component of a quantization error vector;

(c) deriving N ZERO-STATE response error vectors each based on a corresponding one of the N VQ codevectors, wherein each of the N ZERO-STATE response error vectors is a component of a quantization error vector; and

(d) selecting the preferred one of the N VQ codevectors as the VQ output vector corresponding to the residual signal based on the ZERO-INPUT response error vector and the N ZERO-STATE response error vectors.

Independent claim 29 is directed to an NFC system for fast searching N VQ codevectors stored in a VQ codebook for a preferred one of the N VQ codevectors to be used for coding a speech or audio signal. The NFC system of claim 29, includes:

predicting logic adapted to predict the speech signal to derive a residual signal;

a ZERO-INPUT filter structure adapted to derive a ZERO-INPUT response error vector common to each of the N VQ codevectors in the VQ codebook, wherein the ZERO-INPUT response error vector is a component of a quantization error vector;

a ZERO-STATE filter structure adapted to derive N ZERO-STATE response error vectors each based on a corresponding one of the N VQ codevectors in the VQ codebook, wherein each of the N ZERO-STATE response error vectors is a component of a quantization error vector; and

a selector adapted to select the preferred one of the N VQ codevectors as a VQ output vector corresponding to the residual signal based on the ZERO-INPUT response error vector and the N ZERO-STATE response error vectors.

The Examiner has rejected each of independent claims 1 and 29 as obvious based on the combination of Marcellin and Cuperman. In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art at the time of the invention, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or

suggest all the claim elements. *See* MPEP §2143 (Rev. 2, May 2004). As will be described in more detail below, the Examiner's obviousness rejections of claims 1 and 29 are improper because (1) one of ordinary skill in the art would not have been motivated to combine the teachings of Marcellin and Cuperman; and (2) the combination of Marcellin and Cuperman fails to teach or suggest all of the elements of claims 1 and 29.

One of Ordinary Skill in the Art Would Not Have Been Motivated to Combine the Teachings of Marcellin and Watts

Marcellin discloses a Noise Feedback Coding (NFC) structure that uses Trellis Coded Quantization (TCQ) to quantize a prediction residual. Cuperman is directed to a coding structure that performs a Vector Quantizer (VQ) codebook search to code an input speech signal. In Cuperman, vectors representing predicted speech (denoted y(n)) and reconstructed speech (denoted z(n)) are decomposed into zero-input response and zero-state response components as illustrated by equations (15)-(18) at column 8 of Cuperman. This decomposition simplifies the complexity in calculating a reconstruction error associated with a given codevector in a VQ codebook. In Cuperman, "reconstruction error" is defined as the difference between input speech (denoted x(n)) and reconstructed speech z(n).

The Examiner states the one of ordinary skill in the art would have been motivated to combine the teachings of Marcellin and Cuperman because "the method for reconstruction error calculation taught by Cuperman" could be used "to increase speech reconstruction efficiency by reducing the number of required computations [of Marcellin]." However, this statement ignores several important differences between Marcellin and Cuperman, which will be explained below.

In the first place, Marcellin teaches away from the use of vector quantization in a speech coder, advocating the use of a very different quantization scheme entitled Trellis coded quantization (TCQ) as an alternative to vector quantization. As stated in Marcellin:

> The means squared error (MSE) performance of TCQ is excellent. For encoding the memoryless uniform source, TCQ achieves a MSE within 0.21 dB of the distortion-rate function at all positive integral rates. This performance is better than that promised by the best lattices known in up to 24 dimensions [8]. ***In fact, evaluation of the asymptotic quantizer bound [9] indicates that no vector quantizer of dimension less than 69 can exceed the performance of TCQ for encoding the memoryless uniform source.***

See Marcellin, p. 47, second paragraph (emphasis added). Because Marcellin teaches away from performing vector quantization, one of ordinary skill in the art at the time of the invention would not have been motivated to combine Cuperman, which describes a vector quantization scheme, with Marcellin, which advocates against the use of a vector quantization scheme.

Secondly, the coding structures taught by Marcellin and Cuperman are very different and thus one of ordinary skill in the art at the time of the invention would not have been motivated to combine them. Marcellin teaches a conventional Noise Feedback Coding (NFC) structure. The structure disclosed by Cuperman, on the other hand, is not a Noise Feedback Coding structure as that term is used in Marcellin and in the present application. This is because the speech coder in Cuperman does not generate a difference signal between a quantizer input and output, pass this value through a filter, and then add the filtered output to a prediction residual to form the quantizer input signal. As set forth in the specification of the present application:

> In noise feedback coding, the difference signal between the quantizer input and output is passed through a filter, whose output is then added to the prediction residual to form the quantizer input signal. By carefully choosing the filter in the noise feedback path (called the *noise feedback filter*), the spectrum of the overall coding noise can be shaped to make the coding noise less audible to human ears.

See Specification at paragraph [0007].

The differences between the structures described in Marcellin and Cuperman are further manifested in the fact that the structure described in Cuperman is uniquely designed to calculate a "reconstruction error" associated with a coder and to select a VQ codevector that minimizes this error. As noted above, Cuperman defines the "reconstruction error" as the difference between input speech x(n) and reconstructed speech z(n). In contrast, Marcellin does not describe a structure that calculates a reconstruction error, let alone one that implements a quantization scheme to minimize it. Thus, contrary to the assertion of the Examiner, the method for reconstruction error calculation taught by Cuperman is not applicable to Marcellin. Moreover, given the fundamental difference between the coding structures described in Marcellin and Cuperman, it is not at all apparent how one could modify the structure of Marcellin to incorporate the features of Cuperman directed to calculating and minimizing reconstruction error.

The Combination of Marcellin and Cuperman Fails to Teach or Suggest All of the Limitation of Claims 1 and 29

In addition to the foregoing, the Examiner has also failed to meet his burden in establishing a *prima facie* case of obviousness of independent claims 1 and 29 because the combination of Marcellin and Cuperman fails to teach or suggest each and every limitation of those claims.

As noted above, Marcellin is directed to a NFC structure that uses Trellis Coded Quantization (TCQ) to quantize a prediction residual. The Examiner contends that Marcellin teaches "a method and system for improving the perceptual quality of reconstructed speech that is similar to the claimed invention . . . ." *See* Office Action at page 4. However, Marcellin teaches virtually <u>none</u> of the recited elements of independent claims 1 and 29. This is not surprising, given that claims 1 and 29 are each directed to a novel way of performing vector quantization in a Noise Feedback Coding (NFC) system and Marcellin teaches away from the use of vector quantization.

In fact, beyond showing a conventional Noise Feedback Coding structure in which a prediction residual is derived, Marcellin bears virtually no relation to the inventions recited in independent claims 1 and 29. Mere statements by the Examiner that Marcellin teaches various elements of claims 1 and 29, without any underlying support from that reference itself, cannot support a prima facie showing of obviousness. In the Amendment and Reply filed May 13, 2005, Applicant pointed out numerous incorrect assertions made by the Examiner regarding what Marcellin discloses. These points made by Applicant were neither acknowledged nor addressed by the Examiner in the subsequently-issued Office Action. Because the Examiner's rejection of claims 1 and 29 are based on these assertions, the failure of any one of them is sufficient to overcome the Examiner's rejection of claims 1 and 29. These incorrect assertions are addressed in more detail herein:

(1) <u>The Examiner asserts that Figure 1 of Marcellin discloses a method of efficiently searching N predetermined Vector Quantization (VQ) codevectors for a preferred one of the N VQ codevectors to be used in coding a speech or audio signal</u>.

See Office action at page 4. This assertion is incorrect. Figure 1 of Marcellin shows a Noise Feedback Coding Structure that includes a block Q that Marcellin describes as a scalar quantizer (*see* Marcellin at p. 49, first paragraph) and that Marcellin teaches can be replaced by a Trellis Coded Quantizer (*see* Marcellin, p. 49, fourth paragraph). As noted above, Marcellin actually teaches away from the use of vector quantization, and is silent as to any particular method for implementing vector quantization.

(2) The Examiner asserts that deriving a response error vector common to each of the N VQ codevectors is taught at page 48, paragraph 3 through page 49, paragraph 2 of Marcellin. *See* Office Action at page 4. These paragraphs describe an error sequence which is defined as the difference between a sampled speech input-sequence and a coded speech output-sequence (s_i - $\hat{s}_i$) associated with the Noise Feedback Coding Structure of Marcellin's Figure 1. These paragraphs also describe a quantization error sequence q_i, associated with that coding structure. However, neither of these sequences are described as vectors, and neither of these sequences are described as being common to N VQ codevectors.

(3) The Examiner asserts that deriving N response error vectors each based on a corresponding one of the N VQ codevectors is taught at page 50, paragraphs 1-2 of Marcellin. *See* Office Action at page 4. Contrary to this assertion, the cited text simply discusses performing TCQ on a data sequence and appears to have nothing to do with deriving vectors of any kind.

(4) The Examiner asserts that selecting the preferred one of the N VQ codevectors as the VQ output vector corresponding to the residual signal based on the response error vector and the N response error vectors is taught at page 50, paragraph 2,

through page 51, paragraph 1 and equation 10 of Marcellin. *See* Office Action at page 4. Contrary to this assertion, the cited text further describes performing TCQ on a data sequence and appears to have nothing to do with the selection of a preferred codevector.

The Examiner does concede that Marcellin fails to teach or suggest the use of "zero-state response and zero input response error in selecting a preferred codevector". *See* Office Action at page 4. The Examiner states that these elements are taught by Cuperman. As previously argued by Applicant, although Cuperman does describe calculating a "zero input response" and "zero state response" of a filter to select a codevector for the purposes of performing vector quantization, it does not teach deriving "a ZERO-INPUT response error vector common to each of the N VQ codevectors, wherein the ZERO-INPUT response error vector is a component of a quantization error vector" or deriving "N ZERO-STATE response error vectors each based on a corresponding one of the N VQ codevectors, wherein each of the N ZERO-STATE response error vectors is a component of a quantization error vector" as recited in claims 1 and 29.

As explained in the specification of the present application, an embodiment of the present invention decomposes a quantization error vector into a zero-input response error vector and zero-state response error vector:

> A computationally more efficient codebook search method according to the present invention is based on the observation that the feedback structure in FIG. 13C, for example, can be regarded as a linear system with the VQ codevector out of scaled VQ codebook 5028a as its input signal, and ***the quantization error q(n) as its output signal. The output vector of such a linear system can be decomposed into two components: a ZERO-INPUT response vector qzi(n) and a ZERO-STATE response vector zqs (n).*** The ZERO-INPUT response vector qzi(n) is the output vector of the linear system when its input vector is set to zero. The ZERO-STATE response vector qzs(n) is the output vector of the linear

> system when its internal states (filter memories) are set to zero (but the input vector is not set to zero).

See Specification at paragraph [0227]. Cuperman does not anywhere teach or suggest decomposing a vector representing quantization error (or any type of error for that matter) to derive a zero-input response error vector and zero-state response error vectors as claimed. Rather, Cuperman teaches decomposing vectors representing predicted speech y(n) and reconstructed speech z(n) into zero-input response and zero-state response components as illustrated by equations (15)-(18) at column 8 of Cuperman. This difference between Cuperman and the invention of claims 1 and 29 is due in part to the structure of Cuperman's speech coder, which is depicted in FIG. 1 of Cuperman.

Since neither Marcellin nor Cuperman, alone or in combination, teach or suggest each and every feature of independent claims 1 or 29, the combination of Marcellin and Cuperman fail to support a prima facie obviousness rejection of those claims. Also as noted above, one of ordinary skill in the art at the time of the invention would not have been motivated to combine these references. Dependent claims 2-10, 12, 13, 15, 16, 18, 30-38, 40-43 and 45 are also not rendered obvious by the combination of Marcellin and Cuperman for at least the same reasons as independent claims 1 and 29 from which they depend and further in view of their own respective features. Accordingly, the Examiner's rejections of claims 1-10, 12, 13, 15, 16, 18, 29-38, 40-43 and 45 under 35 U.S.C. § 103(a) are likewise traversed and Applicant respectfully request that these rejections be reconsidered and withdrawn.

<u>Rejections over Marcellin, Cuperman and Iijima</u>

The Examiner has rejected claims 20-27 under 35 U.S.C. § 103(a) as being unpatentable over Marcellin in view of Cuperman and further in view of U.S. Patent No.

5,828,996 to Iijima *et al.* ("Iijima"). For the reasons set forth below, Applicants respectfully traverse.

Independent claim 20 is directed to a novel method of deriving a final set of codevectors for use in vector quantization. In particular, claim 20 recites a method of deriving a final set of N codevectors useable for prediction residual quantization of a speech or audio signal in a Noise Feedback Coding (NFC) system. The method of claim 20 includes the steps of:

> (a) deriving a sequence of residual signals corresponding to a sequence of input speech training signals;
>
> (b) quantizing each of the residual signals into a corresponding preferred codevector selected from an initial set of N codevectors to minimize a quantization error associated with the preferred codevector, thereby producing a sequence of preferred codevectors corresponding to the sequence of residual signals;
>
> (c) deriving a total quantization error energy for one of the N codevectors based on the quantization error associated with each occurrence of the one of the N codevectors in the sequence of preferred codevectors; and
>
> (d) updating the one of the N codevectors to minimize the total quantization error energy.

In support of the rejection of claim 20, the Examiner first states that the combination of Marcellin and Cuperman teaches "the method for selecting vectors to minimize a quantization error as applied to claim 1." This statement is incorrect for at least two reasons. First, for reasons set forth above, the combination of Marcellin and Cuperman does not teach or suggest the invention of claim 1. Second, and perhaps more significantly, the Examiner seems to be ignoring the fact that claim 1 and claim 20 recite <u>different</u> methods that include <u>different</u> steps. In particular, claim 1 recites a method for coding a speech or audio signal, whereas claim 20 recites a method for deriving a vector

codebook. Consequently, the alleged teachings of the combination of Marcellin and Cuperman with respect to claim 1 are not relevant to claim 20. As part of making out a *prima facie* case of obviousness of claim 20, the Examiner must identify where the steps of claim 20 (which are different than the steps of claim 1) are taught or suggested in Marcellin and Cuperman. Because the Examiner has not done so, the burden of making a *prima facie* case has simply not been met.

Although the Examiner has not properly set out the elements of a *prima facie* case of obviousness of claim 20, Applicant will nevertheless discuss why the combination of Marcellin, Cuperman and IIjima does not render obvious claim 20.

As discussed above, Marcellin teaches an NFC structure that uses Trellis Coded Quantization (TCQ) rather than vector quantization. Consequently, Marcellin does not teach or suggest "a novel method of deriving a final set of N codevectors useable for prediction residual quantization of a speech or audio signal in a Noise Feedback Coding (NFC) system" as recited in claim 20. Since the structure in Marcellin uses TCQ rather than vector quantization, there is simply no need to derive a final set of codevectors usable for vector quantization in Marcellin.

Cuperman does not remedy the previously-identified deficiencies of Marcellin with respect to claim 20. Although Cuperman teaches a speech coder that utilizes vector quantization, it does not teach or suggest the particular method of deriving a final set of codevectors set forth in claim 20. For example, Cuperman does not teach or suggest the step of "deriving a total quantization error energy for one of the N codevectors based on the ***quantization error*** associated with each occurrence of the one of the N codevectors in the sequence of preferred codevectors" as recited in claim 20, since Cuperman

nowhere teaches or suggests deriving a quantization error. Rather, the only error dealt with in Cuperman is termed a "reconstruction error", which is defined as the difference between the original speech signal x(n) and the reconstructed speech signal z(n).

Furthermore, Iijima does not remedy the previously-identified deficiencies of Marcellin and Cuperman with respect to claim 20. Iijima merely describes the use of vector quantization in a conventional CELP coder. Iijima does not teach or suggest any method of deriving a final set of codevectors, let alone the method for deriving a final set of codevectors in an NFC system as recited in claim 20.

For the foregoing reasons, the combination of Marcellin, Cuperman and Iiijima does not render obvious independent claim 20. Claims 21-27 are likewise not rendered obvious by this combination for the same reasons as independent claim 20 from which they depend and further in view of their own respective features. Accordingly, the Examiner's rejections of claims 20-27 under 35 U.S.C. § 103(a) are traversed and Applicant respectfully request that these rejections be reconsidered and withdrawn.

Rejection over Marcellin, Cuperman and Sasaki

The Examiner has rejected claim 47 as being unpatentable over Marcellin in view of Cuperman and further in view of U.S. Patent No. 5,475,712 to Sasaki ("Sasaki"). For the reasons set forth above, the combination of Marcellin and Cuperman does not teach or suggest all the elements of independent claim 29. Sasaki does not remedy the deficiencies of Marcellin and Cuperman with respect to this claim, and thus the combination of Marcellin, Cuperman and Sasaki does not render claim 29 obvious. Claim 47 is likewise not rendered obvious by the combination of Marcellin, Cuperman and Sasaki for the same reasons as claim 29 from which it depends and further in view of

its own features. Accordingly, Applicant respectfully requests that the rejection of claim 47 under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Other Matters

The Examiner has objected to claims 11, 14, 17, 19, 28, 39, 44 and 46 as being dependent upon rejected base claims. For the reasons set forth above, the rejections of the base claims have been traversed. Accordingly, Applicant respectfully requests that the objection to claims 11, 14, 17, 19, 28, 39, 44 and 46 be reconsidered and withdrawn.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicant believes that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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